Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of:	)	
	)	
The Amendment of Part 97 of the	)	
Commission's Amateur Radio	)	
Service Rules to Clarify Digital	)	
Data Communications	)	RM-11708__
	)	
	)	
By: W. Lee McVey, PE Ret.	)	
	)	
	)	
To: The Chief, Wireless	)	
Telecommunications Bureau	)	
	)	
	)	

COMMENTS

Comes now, W. Lee McVey, PE Ret., licensee of amateur radio station W6EM, who respectfully offers Comments in the above captioned Rulemaking Proceeding.

1. While there is a demonstrated need to eliminate the existing constraint on data communication symbol rate in the Amateur Service, in so doing, *there is a clear and present danger in not specifying a maximum emission bandwidth*. It has been observed that transient bandwidth characteristics of certain data codes employing Orthogonal Frequency Division Multiplexing (OFDM) can suddenly *obliterate* ongoing adjacent communications without warning. Also, unauthorized, unspecified digital data codes (UC)s are in use on the high frequency (HF) amateur bands. I believe that these concerns justify further consideration in this, or yet another, Rulemaking Proceeding.

Background

2. RM-11708, as submitted by the Amateur Radio Relay League (ARRL), proposed expansion of data throughput rates in the HF bands. There is presently a 300 Baud symbol rate restriction that is longstanding and was designated as such to limit bandwidth of radio teletype (RTTY) emissions. But, it has placed limits other data modes as well.[1] Today, data communication is affected through the convolution of audio frequency tone modulation through suppressed-carrier single sideband transmitters. And, this technology has evolved to the point where digital data codes can efficiently compress information within typical transmitter filter pass-bandwidths of about 3 kHz and achieve symbol rates far above the present codified symbol rate limit.[2] And, with the advent of digital signal processors (DSP) taking the place of analog filters in software-defined transmitters, bandpass filtering can be easily adjusted to any bandwidth, literally on-demand. Including expanding to values well beyond 3 kHz, to as much as 10kHz or more. <u>There literally is no maximum bandwidth when computer software can redefine a transmitter signal bandwidth when active device filtering is employed</u>.

3. The Commission has long recognized that digital data codes could be used to cipher or otherwise limit interception of communications. Such codes could be used over great distances to send and receive coded information. Communications which might aid those who wish to harm the United States, its interests, or its citizens. In addressing what amounts to a national security concern, the Commission's historical posture has been to limit authorized data codes on the HF bands to specified codes (SC)s that have publicly released protocol definitions and symbol tables. HF Amateur Service data communications are supposed to be restricted to only those codes.[3] UCs that are not fully public are authorized for use only on short-range VHF and UHF allocations. Although the meaning seems unambiguous, some think that verbal discussion or a flow chart of code information flow is equivalent to a complete code specification.[4] It is not. This confusion has been exploited to the point that some think that OFDM data codes PacTOR II, PacTOR III, and now PacTOR IV somehow meet the requirements for being SCs. With

[1] §97.307(f)3.
[2] A much higher symbol rate is possible with multiple subcarrier OFDM modulation schemes.
[3] §97.309(a)4 lists only some of those codes, and its inclusion of PacTOR sans-version, aggravates this situation.
[4] See http://ecjones.org/pactor.html for a verbose dialog about PacTORs II, and III.

little effort, one can discover that the PacTOR creator, SCS GmbH, has not and will not release the protocol specification definitions, symbol tables and mathematical modulation functions in sufficient detail so that other manufacturers or amateurs themselves can construct modem equipment and/or firmware to utilize or monitor any of these PacTOR versions. PacTOR I, however, is an exception. Part of the reason for this confusion lies in the §97.309(a)4 list since PacTOR is included and designated as an SC. However, *the only PacTOR code that thus far meets the SC requirement is what is now known by amateur licensees as PacTOR I.*[5]

4. There are many digital data codes with fully released characteristics and some of which are public domain freeware. Most popular with amateur operators are keyboard codes such as JT-65 and PSK-31, that are very narrow in bandwidth. Most importantly, these data codes stay within a defined, relatively constant bandwidth of less than 500Hz when in use. Problematic for amateurs operating nearby are codes which employ OFDM, (typically 2K80J2D) which by their nature, may not be constant bandwidth. OFDM codes can employ means to increase or decrease bandwidth suddenly and unpredictably. From perhaps bandwidths less than 1kHz initially, to as wide as a software-defined DSP-equipped radio transmitter could expand them to. OFDM typically consists of a pattern of equal amplitude subcarriers, equally spaced apart from the carrier frequency, typically in a single, suppressed-carrier sideband. The number of subcarriers and the utilized bandwidth on at least one OFDM code is designed to increase under bettering signal conditions when lower error rates are perceived. There are several publicly released OFDM codes, including CLOVER, OLIVIA, MT-63 and STANAG 5066/2G-ALE, which should be listed or added as SCs, as the case may be.

Discussion

5. Clearly, there is need for data definition refinement to address usage trends in data codes. Automatic stations that are used to transfer voluminous content from point to point are presently restricted to small segments on each HF band. For the most part, these

[5] Even more confusion has been generated by using ARRL's suggestion of UC PacTOR III as an exemplar OFDM mode in the 60M allocation table at §97.307(f)14.

stations employ OFDM coding to most efficiently transfer data files quickly. However, there are issues with use of some of these codes as stated above, not the least of which is need for very accurate carrier frequency alignment and good to excellent propagation conditions. Simply stated, tolerances typically less than 100Hz are required in order that signals can be properly detected with subcarriers aligned to where predicted. As such, a channel frequency is most often pre-selected so as to allow accurate transfer of content. And again, the potential for bandwidth expansion presents issues for any stations operating nearby. Practically speaking, unless an amateur station has spectral analysis display capability, or an OFDM-mode-capable modem, it cannot discern whether or not an adjacent communication is or is not OFDM coding. And, very likely unaware of the impending peril of initiating communications anywhere near the signal envelope.

6. The existing rationale for constraint of broader-bandwidth automatic, unattended OFDM stations in specific sub bands makes perfect sense and should continue. Their operation should only be permitted in those segments and not allowed elsewhere unless constrained to narrow bandwidth. As it stands now, automatic stations can only operate elsewhere when emission bandwidths are limited to 500Hz or less.[6] This essentially removes frequency restrictions for automatic and relay stations employing predictable, narrow bandwidths. In its narrow bandwidth exemption for such stations, the Commission has recognized that there would not be *explosive expansions* of OFDM digital data signal bandwidth as would definitely occur with wider bandwidth codes.

7. OFDM is rarely used as just a keyboard code. Speed of throughput is hardly ever an issue when typing at keyboard speed. Since there is little justification for OFDM unless passing large data file blocks, it could be restricted to authorized frequency sub band segments. Again, the need for constraint is based upon the possibility of unpredictable transient bandwidth expansion in the vicinity of other, on-going two-way digital communications. All OFDM communications, whether from an attended or unattended station, could be constrained to the segments now set aside for automatic digital station communications with little adverse impact.

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[6] §97.221(c)2

8. Transmission of third party traffic is an important purpose of the Amateur Service. Especially during and following disasters and national emergencies. However, with high capacity OFDM UCs being used to handle third party traffic, there already has been demonstrated abuse.[7] The majority of amateurs can decode very few OFDM signals that are SCs, let alone those UCs such as PacTORs II, III and IV without expensive, proprietary modems. Quite simply, transmission content cannot be easily examined either by the Commission's Enforcement Bureau or by Amateur Service volunteer Official Observers in order to identify whether or not data content is appropriate and lawful.

Summary

9. In view of the above, the Commission should reconsider its proposed removal altogether of bandwidth limits in this Proceeding and also consider the changes proposed herein. A *Further Notice of Proposed Rulemaking* should be issued in order to (1) incorporate a default bandwidth limit of 2.8kHz for HF digital data transmissions; (2) constrain all but less than 500Hz OFDM transmissions to automatic station sub-bands; and (3) remove the ambiguity concerning what are considered to be SCs. The list of SCs should *only* include those that truly have been fully released to the public domain.

Proposed Modifications to Part 97 Sections

The following are proposed revisions incorporating the issues presented above. Proposed additions are underscored; proposed deletions are struck-through:

§97.305(f) The following standards and limitations apply to transmissions on the frequencies specified in §97 .305(c) of this part.

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(3)~~Only a~~ A RTTY or data emission using a specified digital code listed in § 97.309(a) of this part may be transmitted; except that all stations employing Orthogonal Frequency Division Multiplex (OFDM) codes that occupy in excess of 500Hz bandwidth are limited to the segments in §97.221(b). ~~The symbol rate must not exceed 300 bauds, or for frequency shift keying, the frequency shift between mark and space must not exceed 1kHz.~~ The authorized bandwidth, as defined by § 2.202(a), is 2.8 kHz.

[7] Comments of Janis Carson, RM-11708 and RM-11769, pages 3 and 4.

(4) A RTTY or data emission using a specified digital code listed in § 97.309(a) of this part may be transmitted; except that all stations employing Orthogonal Frequency Division Multiplex (OFDM) codes that occupy in excess of 500Hz bandwidth are limited to the segments in §97.221(b). ~~The symbol rate must not exceed 1200 bauds, or for frequency shift keying, the frequency shift between mark and space must not exceed 1kHz~~. The authorized bandwidth, as defined by § 2.202(a), is 2.8 kHz.

(5) A RTTY, data or multiplexed emission using a specified digital code listed in § 97.309(a) of this part may be transmitted. ~~The symbol rate must not exceed 19.6 kilobauds.~~ A RTTY, data or multiplexed emission using an unspecified digital code under the limitations listed in§ 97.309(b) of this part also may be transmitted. The authorized bandwidth as defined by § 2.202(a), is 20 kHz.

(6) A RTTY, data or multiplexed emission using a specified digital code listed in § 97.309(a) of this part may be transmitted. ~~The symbol rate must not exceed 56 kilobauds.~~ A RTTY, data or multiplexed emission using an unspecified digital code under the limitations listed in § 97.309(b) of this part also may be transmitted. The authorized bandwidth as defined by § 2.202(a), is 100 kHz.

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§97.307(f)

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(14) In the 60 m band:

(i) A station may transmit only phone, RTTY, data, and CW emissions using the emission designators and any additional restrictions that are specified in the table below (except that the use of a narrower necessary bandwidth is permitted):

60M Band Emission Requirements

Emission type	Emission designator	Restricted to:
Phone	2K80J3E	Upper sideband transmissions (USB).
Data	2K80J2D	USB (for example, ~~PACTOR-III~~ OLIVIA).
RTTY	60H0J2B	USB (for example, PSK31).
CW	150HA1A	Morse telegraphy by means of on-off keying.

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47 CFR § 97.309(a) Where authorized by §§ 97.305(c) and 97.307(f) of the part, an amateur station may transmit a RTTY or data emission using the following specified digital codes:

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(4) An amateur station transmitting a RTTY or data emission using a digital code specified in this paragraph may use any technique whose technical characteristics have been documented publicly, such as CLOVER, G-TOR, OLIVIA, JT-65, ~~or PacTOR~~ PacTOR I, PSK-31 or STANAG 5066 for the purpose of facilitating communications.

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Respectfully Submitted,

/s/

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Life Senior Member, Institute of Electrical and Electronic Engineers (IEEE)
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